10.2478/mbs-2013-0018

Medical and Biological Sciences, 2013, 27/3, 11-14

REVIEW / PRACA POGLĄDOWA

Jakub Puchała, Dariusz Mątewski, Małgorzata Puchała

RESULTS OF TREATMENT OF HALLUX VALGUS DEFORMITY BY MEAN OF A FIRST METATARSAL PROXIMAL OSTEOTOMY WITH SOFT TISSUE PLASTY OF I MTP JOINT

WYNIKI LECZENIA DEFORMACJI KOŚLAWEJ PALUCHA OSTEOTOMIĄ PIERWSZEJ KOŚCI ŚRÓDSTOPIA I PLASTYKĄ TKANEK MIĘKKICH STAWU ŚRÓDSTOPNO-PALICZKOWEGO PIERWSZEGO

Department of Orthopedics and Traumatology, Jurasz University Hospital,
Ludwik Rydygier College of Medicine in Bydgoszcz, Nicolaus Copernicus University in Torun.
Acting Head: Marek Jedwabiński, Phd

Summary

Approximately 40 to 50% of the civilized population may expect feet disorders, and in 90% localized in the forefoot. Hallux valgus (H.V.) deformity is not a single malformation, but a complex problem affecting the first ray of foot, frequently accompanied by deformities and symptoms of the lesser toes. Proximal osteotomy and soft tissue release of I metatarso-phalangeal joint (MTP) provides adequate correction of intermetatarsal angle and joint alignment.

Material and methods. 66 patients (56 women and 10 men) with 84 hallux valgus deformities treated by surgical corrections with proximal wedge osteotomy of the first metatarsal bone and soft tissue plasty of I MTP joint were evaluated. The average age of the patients was 52.8 years (±12.4) and the mean follow-up was 4.2 years (±1.0). Mann criteria were used to assess the radiological stage of the disease. Treatment results were assessed by means of numerical AOFAS scale. On the basis of the sum of points obtained for each criterion, the treatment result was qualified as: excellent, good, fair or poor. In the radiological assessment the alteration of the valgus angle (HVA) and the intermetatarsal angle (IMA) of the hallux were evaluated.

Results. Exacerbation of hallux valgus deformity in radiological examination was moderate or severe in accordance to the Mann criteria. 21 feet accompanied by deformities of lesser toes had additionally surgical procedure for the treatment of them. The mean score in AOFAS scale was 91.2pts (±11.2) with percentage of 80.6% excellent and good results. Higher percentage of fair and poor results in AOFAS scale was due to restricted motion of first MTP joint in 8 patients, out of who due to persistent pain ailments in 6. In case of 4 feet, cosmetic improvement was unsatisfactory, and 4 patients had problems with wearing commercial shoes. Average correction value of the hallux valgus angle was 21° (from 33.5° to 12.5°). Foot metatarsal angle correction was 9° (from 16.2° to 7.2°).

Conclusions. Proximal osteotomy of the first metatarsal bone with soft tissue release of I metatarso-phalangeal joint allows for good correction of the hallux valgus deformity with good functional results.

Streszczenie

Wśród cywilizowanych społeczeństw od 40 do 50% populacji ma lub będzie mieć jakieś problemy ze stopami.
90 % z nich dotyczy przodostopia.

Materiał i metoda: U 66 chorych wykonano 84 zabiegów plastyki tkanek miękkich st. MTP I z klinową osteotomią proksymalną I kości śródstopia. Operowano 56 kobiet i 10 mężczyzn. Średnia wieku wyniosła 52,8 (±12,4) lat. Nasilenie deformacji w obrazie radiologicznym było średniego lub znacznego stopnia zgodnynie z kryteriami Manna. Średnia długość obserwacji wyniosła 4,2 lat. Wyniki leczenia oceniano przy pomocy liczbowej skali AOFAS. Na podstawie uzyskanych punktów wynik leczenia kwalifikowano jako: bardzo dobry, dobry, zadawalający lub zły. W ocenie radiologicznej oceniono zmianę kąta koślawości palucha i kąta metatarsalnego.

Wyniki: W skali Mielkiego średni wynik punktowy

wyniósł 6,5 (±1,9), a wyniki leczenia 95,2% zoperowanych stóp oceniono jako bardzo dobre i dobre. Natomiast średni wynik leczenia wg skali AOFAS wyniósł 91,2 (±11,2) przy odsetku 80,6% wyników dobrych i bardzo dobrych. Większy procent chorych z dostatecznym lub złym wynikiem wg skali AOFAS związany był z ograniczeniem zdolności poruszania się przez 8 chorych, w tym u 6 z powodu utrzymujących się dolegliwości bólowych. 4 stopy wykazywały niezadawalającą poprawę kosmetyczną, a 4 chore miały stały problem z noszeniem obuwia. Średnia korekcja wartości kąta koślawości palucha wyniosła 21° (62,7%), zmniejszając jego średnią z 33,5° do 12,5°. Korekcja kąta metatarsalnego stopy wyniosła 9° (55,4%), zmniejszając średnią jego wartość z 16,2° do 7,2°.

Wnioski: Osteotomia proksymalna I kości śródstopia z plastyką tkanek miękkich st. MTP I pozwala na dobrą korekcję deformacji koślawej palucha. Sprzyja to osiąganiu dobrych wyników czynnościowych. Potwierdzają to uzyskane wyniki oceniane w skali AOFAS.

Key words: Hallux valgus, surgical treatment, proximal osteotomy

Słowa kluczowe: Paluch koślawy, leczenie operacyjne, osteotomia proksymalna

INTRODUCTION

Correct shaped foot allows optimal and painless load transfer both during standing and walking. It is an important factor enabling human to perform many daily activities both associated with the work and with sport and recreation. The frequency of health problems associated with acquired foot pathology against background of static disorders is increasing in civilized society at the same time. Most of them concern the forefoot and is related with the wrongly adjusted footwear. It is related to with the fashion trends of shoes for which looks, especially fronts of them, is more important than a function. Therefore, hallux valgus deformity concerned mainly civilised, wearing footwear society. The studies of Sim Lam Fook and Hogson have shown its presence among 33% of the population wearing shoes in the comparison to 1.9% of the no "shoed" population [1].

Also Robinson mentions that an important cause of the hallux valgus is wearing shoes, especially modern designed with high – heels [2]. Hallux valgus is the most frequent and clinically significant disorder of forefoot. It is a final stage of instability of first ray of the foot. It consists of first metatarsal varus, forefoot widening, lateral subluxation of first metatarsophalangeal joint (MTP I), lateral displacement of sesamoids and pronation position of hallux. Besides the extrinsic factors, factors associated with foot itself, able to have an influence on development of forefoot deformation, have both the genetic character, as well as static [1,2].

Complexity and intensity of first ray deformity with hallux valgus caused that a various surgical techniques were described over the last decades; still the most satisfactory method for a patient and a doctor is searched for. Wolke counted more than 100 methods of surgical treatment starting from soft tissue procedures by the corrective osteotomy and joint resectional arthroplasty till ending with MTP I fusion [3]. Robinson and Jones in their study report that for over the past 100 years about 130 types of procedures have been described.

Such a great number of therapeutic possibilities is causing a bad preoperative evaluation of the deformity and inappropriate choice of the surgical procedure results in a significant percentage of patients dissatisfied with the results of treatment [2,4]. Therefore, Mann and also Stephens thought that the achievement of therapeutic success is impossible using just only one surgical technique. They emphasis the necessity of proper selection of surgical method in dependence on a physical examination, a radiological assessment, a patient's age and needs of daily and recreation activity [1,5].

One of the techniques for restoration of physiological terms of first ray in patients is proximal wedge osteotomy combined with soft tissue plasty of I MTP joint with the liberalization of the adductor hallucis tendons [1,2,5,6,7,8,9,10]. The aim of this study was to evaluate retrospectively the result of surgical treatment of hallux valgus deformity using a proximal wedge osteotomy of the first metatarsal with tissue liberalization

MATERIAL AND METHODS:

Between 2000 and 2004 in the Department of Orthopedics and Traumatology 66 patients with 84 hallux valgus deformities were treated surgically by means of a proximal wedge osteotomy of the first metatarsal bone combined with soft tissue plasty of I MTP joint. There were 56 women and 10 men. 18 patients had done osteotomy of both feet. The average age of the patients was 52.8 years (±12.4) and the mean follow-up was 4.2 years (±1.0) (Fig. 1)

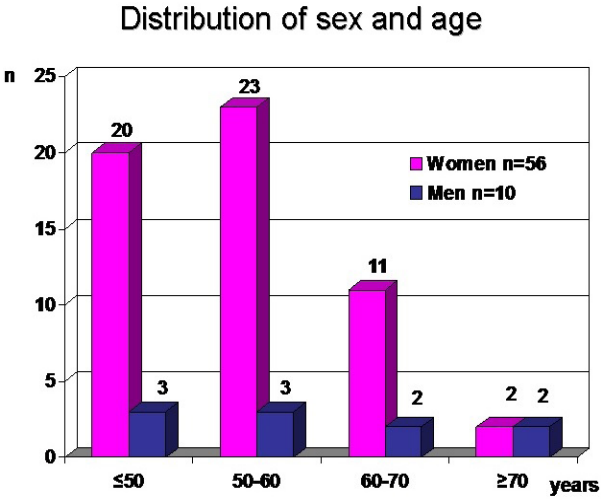

Figure 1. *Distribution of sex and age of the treated population.*

Rycina 1. *Rozkład płci i wieku operowanej populacji*

For this surgical procedure feet with moderate and severe valgus deformity of hallux in accordance to the classification Mann and Coughlin were qualified, which demonstrated the radiographic Hallux Valgus Angle (HVA) above 30 degrees and the Intermetatarsal Angle (IMA) above 15 degree (Tab. I) The duration of the follow up was from 33 months to 72.8

months (average 49.1 months). Results were evaluated using AOFAS scale (Tab. II). Mean BMI was 24.3 (±2.5) and ranged from 17.8 to 29.7. BMI influence on post-operative values of HVA and IMA was evaluated. Statistical analysis was performed using t-Student test and two fractions test.

Mild	HV<30 IM<15	N=0
Moderate	30<HV<40 15<IM<20	N=68
Severe	HV>40 HV>20	N=16

Table I. *Radiological classification of hallux valgus deformity (Mann and Coughlin)*

Tabela I. *Klasyfikacja nasilenia koślawości palucha wg Manna i Coughlina*

Criteria		points
PAIN		0 -40
FUNCTION max. 45pts	Activity limitations	0 – 10
	Footwear requirements	0 – 10
	I MTP joint motion	0 – 10
	IP joint motion	0 - 5
	MT – IP stability	0 – 5
	Callus of forefoot region	0 – 5
ALIGNMENT		0 - 15

Table II. *AOFAS Scale. Results: Excellent - 100-90pts, good -89-80pts, fair – 79-70pts, poor <70pts*

Table II. *Skala AOFAS (the american orthopaedic foot and ankle society)*

Additionally the final radiological results of the treatment were evaluated according to criteria of the value of the HVA and the IMA angle as in Table III

good	satisfactory	poor
HV<20 degree HV<11 degree	20<HV<30 11<IM<15	HV>30 degree IM>15 degree

Table III. *Radiological Scale*

Tabela. III *Skala oceny radiologicznej*

SURGICAL TECHNIQUE:

Patients were surgically treated in spinal anaesthesia with temporary lower limb ischemia. By the lateral approach the lateral sesamoid bone was identified and the adductor hallucis tenotomy was performed. In the next step the L-shaped MTP I arthrotomy with partial resection of the joint capsule and removal of medial exostosis of first metatarsal head by the second medial approach were performed. To restore a proper formation of the transverse arch of the forefoot the standard proximal wedge osteotomy, which corrected first metatarsal varus deformity, was performed. 2 Kirschner wires were used to fix osteotomy, and then the soft tissue plasty of MTP I joint was performed. The wounds closed after the control of homestasis. When wound dressing was done, foot was immobilized in a plaster cast.

RESULTS:

In the final evaluation of the studied group of patients we stated very excellent result in 42 feet (50%), well in 26 (30.95%), fair in 7 (8.33%) and poor in 9 feet (10.7%).

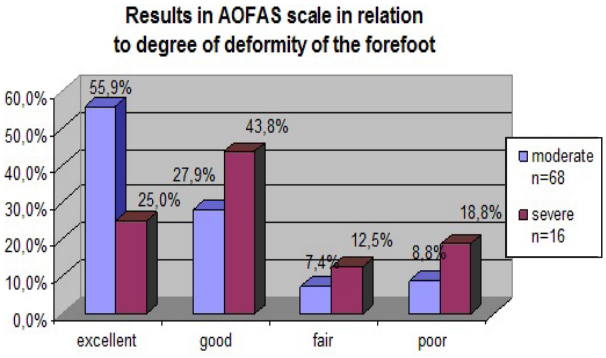

Figure 2. *Distribution of results in AOFAS scale in relation to the severity of deformity of the forefoot*

Rycina 2. *Rozkład wyników w skali AOFAS w zależności od nasilenia deformacji przodostopia*

The mean result in AOFAS scale was 86pts (±12.7). However, the percentage of feet with excellent and good result was 81%. In patients with moderate deformity the percentage of feet with excellent and good result was 83.8% and was higher by 15% than in the group with severe deformity. Differences of percentage of excellent results between groups with moderate and severe deformity were statistically significant (p=0.03). Patients from the group with severe deformity predominated

among good, fair and poor results, but differences were not significant between both groups.
10.7% percent of poor result was connected with: 5 patients had limitation of walking ability, among them 4 had severe pain. 5 feet showed unsatisfactory cosmetic improvement and 3 patients had to wear modified shoes.

		Deformation	
	Mild	Moderate	Severe
Good	HVA<20 IM<11	59(86,8%) 65(95,6%)	8(50%) 9(56,3%)
Fair	20<HVA<30	7(10,3%)	7(43,7%)
Poor	HVA>30 IM>15	0 (0%) 0(0%)	1(6,3%) 1(6,3%)

Table IV: *Timetables and radiological results depending on the degree of deformation*

Tabela IV. *Rozkład wyników radiologicznych w zależności od stopnia deformacji*

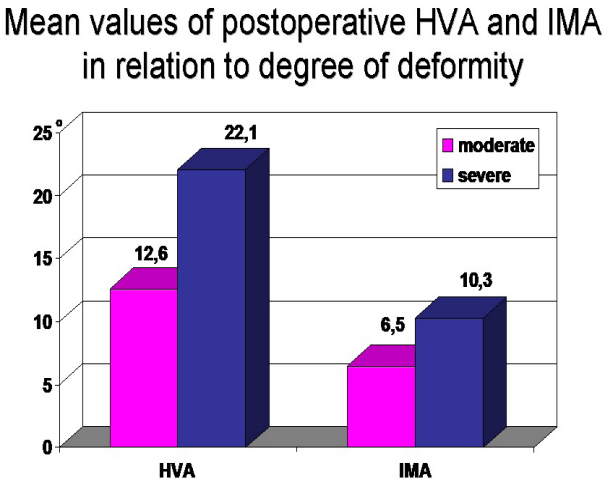

Figure3. *The average correction angle HV and IM, depending on the severity preoperative deformity*

Rycina 3. *Średnia korekcja kąta HV i IM w zależności od przedoperacyjnego nasilenia deformacji*

The average correction of the hallux valgus angle was 22.7° (range from 6° to 46°), causing a decrease of its mean value from 37.1° to 14.4°. Average correction of intermetatarsal angle was 10.9° (ranged from 5° do 17°), causing a decrease of its mean value from 18.1° to 72°.
The percentage of good radiological results in relation to the HVA was 86.8% in patients with moderate deformity, and of IMA was 95.6%. It was associated with that angle correction respectively by o 12.6° and 6.5° (p<0.000047, p<0.000045). The severe deformity was connected with weak improvement of those radiological angles. In this group the percentage of good correction HV angle was 50 % and IM angle was 56.3%, what was associated with mean correction respectively by 22.1° and 10.3° (p<0.000047, p<0.000045) (Tab. IV, Fig. 3)

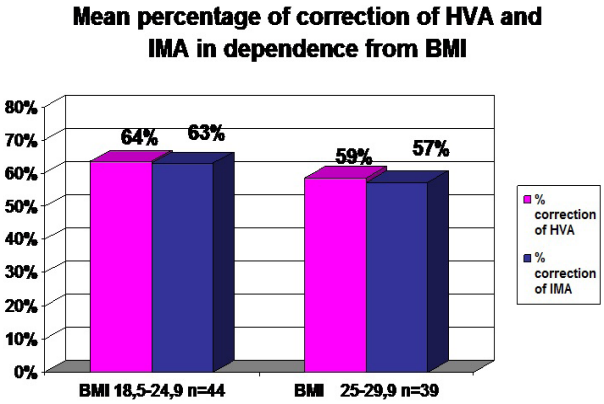

Figure 4. *The average percentage correction of angles, depending on BMI of patients undergoing surgery*

Rycina 4. *Średni procent korekcji kątów HV i IM w zależności od wskaźnika BMI operowanych chorych*

In patients overweight percentage correction of HVA and IMA was respectively lower by 5% and 6% than in patient with normal body mass index. One patient with BMI below 18.5 was excluded from the analysis. Revealed differences were not statistically significant, so we stated that BMI index did not influence preoperative radiological parameters of hallux valgus deformity, neither did it influence the volume of correction. (Fig. 4).
We did not observe any vascular necrosis and non-union in our material.

DISCUSSION:

Domination of women in our material was significant (84.9%). There were mainly patients below 60 years (65.2%). A similar proportion among women was presented in Wolke et al. study (98.4%) [3] and Jones et al study (87.5%) [4].

A possibility of large correction of metatarsal angle value is an advantage of the proximal first metatarsal osteotomy combined with the liberalization of the MTP I joint. [1,2,6,7,8,9,10] Robinson reported huge corrective potential of this type of procedures; however, he brings forward shortening of the first ray of foot accompanying this method [2]. Nyska mentions only metatarsalgia as a common complication after the treatment of hallux valgus [11]. According to the Trnka's studies a shortening of the first ray of foot may be the cause of metatarsalgia in the distant follow up. However, the author mentions a proximal I metatarsal osteotomy with the soft tissue release of MTP I as a reason of metatarsalgia only in 5.9% in the presented material [12]. Therefore, in preoperative planning a relative contraindication to this type of procedure is a foot formation with too short first metatarsal bone contrary to other metatarsal. When this fact is confirmed in a preoperative radiological examination it should lead to a choice of other type of procedure, not causing the unfavorable effect of the first ray shortening and increasing of metatarsalgia symptoms.

Corrective procedures using a proximal I metatarsal osteotomy with the soft tissue release of MTP I in the treatment of forefoot disorder with moderate and severe hallux valgus deformity, according to the Mann and Coughin classification, are favorable to good functional results. Thanks to this type

of corrective procedure Wolke et al. obtained 92.9% of the favorable, post-operative results (excellent, good and fair) [3]. Nigro et al. and Wanivenhaus et al. analyzing their materials obtained also similar results [9, 10]. Also our 81% of excellent and good results, according to the AOFAS scale, confirms usefulness of this type of surgical procedure in the treatment of hallux valgus deformity.

We have obtained the volume of correction of hallux valgus angle similar to those obtained by Okuda[8]. 22.7° correction of the HVA found by us is comparable with 25° described in his paper with simultaneously reducing the IMA by about 11 degrees, which was reduced about 10.9 degrees in our study.

CONCLUSIONS:

1. Surgical treatment of forefoot disorder with moderate and severe hallux valgus deformity, according to the Mann and Coughin classification, using a proximal wedge I metatarsal osteotomy with the soft tissue release of MTP I allows both good correction of hallux valgus and I metarsal varus deformity.
2. A high percentage of cosmetic and functional results favorable for patients allow using the described procedure.
3. The volume of reduction of HVA and IMA depend on the preoperative severity of deformity.
4. There was no statistically significant relationship between the patient's BMI and the achieved correction of HVA and IMA.

REFERENCES:

1. R.A Mann, M.J. Coughlin" Surgery of the foot and ankle.", 8th edition 2007r
2. A.H. Robinson, J.P Limbers, Modern concepts in the treatment of hallux valgus" JBJ 2005; 88 1038-45
3. B Wolke, M. Sparmann, Results after distal Austin and proximal displacement osteotomy: therapy for hallux valgus". Food and ankle surgery 1999, s.47-52.
4. S. Jones, H.A. Al Hussainy et al, "Scarf osteotomy for hallux valgus", JBJS 2004, 88 830-836
5. M.M Stephens "Does shortening of at the first ray in the treatment of adolescent hallux valgus prejudice the outcome? JBJS,Jul.2006,88.7, 858-859
6. H.B Kitaoka "The foot and ankle", 2nd edition, 2002 , str.71-98
7. S.N Anjum, F. Denolf "Basal osteotomy with lateral soft tissue release and medical placation in the correction of moderate to serve hallux valgus" Foot and ankle surgery 12(2006), 13-17
8. Okuda R, Kinoshita M. et al "Distal soft tissue procedure and proximal metatarsal osteotomy in hallux valgus, Clin. Orthop. Relat. Res, 2000, 379 209-217
9. Nigro J.S, Catonzaratii A.R, Greger G.M "Closing base wedge osteotomy". J Foot surg, 1991, 30, 494-505.
10. Wanivenhaus A.H, Feldner – Busztin H, Basal osteotomy of the first metatarsal forcorrection of metatarsus primus varus associated with hallux valgus , foot and ankle 1998,8: 3337-343.
11. M. Nyska, A. Liberson, C. Mc Cabe, K. Linge, L. Klenerman, Plantar fast pressure distribution in patients with hallux valgus treated by distal soft tissue procedure and proximal metatarsal osteotomy", "Foot and ankle Surgery" 1998 4:35-41
12. H-J. Trnka, Ch. Gebhard. et al" The Weil osteotomy for treatment of dislocated lesser metatarsophalangeal joints", Acta Ortp., Scond. 2002, 73(2) 190-194

Address for correspondence:
Szpital Uniwersytecki Nr 1
Klinika Ortopedii i Traumatologii Narządu Ruchu
ul. M. Skłodowskiej-Curie 9, 85-094 Bydgoszcz
Dr n. med. Dariusz Mątewski

Received: 27.05.2013
Acceoted for publication: 26.08.2013